

Claims

[c1] What is claimed is:

1.A switched capacitor circuit comprising:
a first positive side switch element for selectively connecting a first positive side node to a second node according to a first control signal, wherein the first positive side node is connected to a positive side capacitor; and
a precharge circuit connected to the first positive side node for precharging the first positive side node to a precharge voltage for a predetermined time when the switched capacitor circuit is switched off.

[c2] 2.The switched capacitor circuit of claim 1, wherein the predetermined time is independent of the first control signal.

[c3] 3.The switched capacitor circuit of claim 1, wherein the precharge circuit comprises:
a second positive side switch element for selectively connecting a third node to the first positive side node according to a second control signal;
a precharge switch element for selectively connecting a fourth node to the third node according to the first control signal, the fourth node being at the precharge volt-

age; and
a delay unit for generating the second control signal,
wherein the second control signal is the first control sig-
nal delayed by the predetermined time.

- [c4] 4.The switched capacitor circuit of claim 3, wherein the delay unit comprises a low-pass filter connected to the first control signal, the second control signal being the output of the low-pass filter.
- [c5] 5.The switched capacitor circuit of claim 3, wherein the delay unit comprises a delay chain, the input of the delay chain being the first control signal and the output of the delay chain being the second control signal.
- [c6] 6.The switched capacitor circuit of claim 3, wherein the precharge circuit further comprises:
a third positive side switch element being connected between the third node and the first positive side node, the control terminal of the third positive side switch element being connected to the first positive side node.
- [c7] 7.The switched capacitor circuit of claim 6, wherein the third positive side switch element is of a larger size than the first and second positive side switch elements.
- [c8] 8.The switched capacitor circuit of claim 3, further com-
prising:

a first negative side switch element for selectively connecting a first negative side node to the second node according to the first control signal, the first negative side node being connected to a negative side capacitor, and the first negative side switch element being of substantially the same size as the first positive side switch element;

wherein the precharge circuit further precharges the first negative side node to the precharge voltage when the switched capacitor circuit is switched off according to the first control signal.

- [c9] 9. The switched capacitor circuit of claim 8, wherein the precharge circuit further comprises:
a second negative side switch element for selectively connecting the third node to the first negative side node according to the second control signal, the second negative side switch element being of substantially the same size as the second positive side switch element.

- [c10] 10. The switched capacitor circuit of claim 9, further comprising a center switch element for selectively connecting the first positive side node to the first negative side node according to the first control signal.

- [c11] 11. The switched capacitor circuit of claim 9, wherein the precharge circuit further comprises:

a third positive side switch element being connected between the third node and the first positive side node, the control terminal of the third positive side switch element being connected to the first positive side node; and a third negative side switch element being connected between the third node and the first negative side node, the control terminal of the third negative side switch element being connected to the first negative side node, wherein the third negative side switch element is of substantially the same size as the third positive side switch element.

- [c12] 12. The switched capacitor circuit of claim 11, wherein the third positive and negative side switch elements are of a larger size than the first and second positive and negative side switch elements.
- [c13] 13. The switched capacitor circuit of claim 11, further comprising a center switch element for selectively connecting the first positive side node to the first negative side node according to the first control signal.
- [c14] 14. The switched capacitor circuit of claim 13, wherein the second node is ground, the fourth node is a DC power supply node, the precharge switch element is a p-type transistor, and the first and second positive and negative side switch elements and the center switch ele-

ment are n-type transistors.

- [c15] 15.The switched capacitor circuit of claim 13, wherein the second node is a DC power supply node, the fourth node is ground, the precharge switch element is an n-type transistor, and the first and second positive and negative side switch elements and the center switch element are p-type transistors.
- [c16] 16.A method for switching off a switched capacitor circuit, the method comprising the following steps:
 - (a) disconnecting a first positive side node from a second node according to a first control signal using a first positive side switch element; and
 - (b) precharging the first positive side node to a precharge voltage for a predetermined time when the switched capacitor circuit is switched off.
- [c17] 17.The method of claim 16, wherein the predetermined time is independent of the first control signal.
- [c18] 18.The method of claim 16, wherein step (b) comprises the following steps:
 - (c) connecting a fourth node to a third node according to the first control signal using a precharge switch element, the fourth node being at the precharge voltage;
 - (d) delaying the first control signal by the predetermined

time to create a second control signal; and
(e) connecting the third node to the first positive side node according to the second control signal using a second positive side switch element.

- [c19] 19.The method of claim 18, wherein step (d) comprises low-pass filtering the first control signal.
- [c20] 20.The method of claim 18, wherein step (d) comprises inputting the first control signal into a delay chain, the output of the delay chain being the second control signal.
- [c21] 21.The method of claim 18, wherein step (b) further comprises:
providing a third positive side switch element being connected between the third node and the first positive side node, the control terminal of the third positive side switch element being connected to the first positive side node.
- [c22] 22.The method of claim 21, wherein the third positive side switch element is of a larger size than the first and second positive side switch elements.
- [c23] 23.The method of claim 18, wherein step (b) further comprises:
connecting a first negative side node to the second node

using a first negative side switch element according to the first control signal, the first negative side node being connected to a negative side capacitor, and the first negative side switch element being of substantially the same size as the first positive side switch element; wherein step (b) further comprises precharging the first negative side node to the precharge voltage when the switched capacitor circuit is switched off according to the first control signal.

- [c24] 24. The method of claim 23, wherein step (b) further comprises:
connecting the third node to the first negative side node using a second negative side switch element according to the second control signal, the second negative side switch element being of substantially the same size as the second positive side switch element.
- [c25] 25. The method of claim 23, further comprising connecting the first positive side node to the first negative side node according to the first control signal using a center switch element.
- [c26] 26. The method of claim 23, wherein step (b) further comprises:
providing a third positive side switch element being connected between the third node and the first positive side

node, the control terminal of the third positive side switch element being connected to the first positive side node; and

providing a third negative side switch element being connected between the third node and the first negative side node, the control terminal of the third negative side switch element being connected to the first negative side node, wherein the third negative side switch element is of substantially the same size as the third positive side switch element.

- [c27] 27. The method of claim 26 wherein the third positive and negative side switch elements are of a larger size than the first and second positive and negative side switch elements.
- [c28] 28. The method of claim 26 further comprising connecting the first positive side node to the first negative side node according to the first control signal using a center switch element.
- [c29] 29. The method of claim 28 wherein the second node is ground, the fourth node is a DC power supply node, the precharge switch element is a p-type transistor, and the first and second positive and negative side switch elements and the center switch element are n-type transistors.

[c30] 30.The method of claim 28, wherein the second node is a DC power supply node, the fourth node is ground, the precharge switch element is an n-type transistor, and the first and second positive and negative side switch elements and the center switch element are p-type transistors.